

# **Interactive Classrooms with Student Response Systems**

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**Abstract:** Teachers face a variety of demands. Developing lesson plans and assessing student work are fundamental and time consuming. Moreover, teachers are asked to differentiate their lessons to accommodate a variety of learning styles, participate in school improvement committees, and supervise extracurricular activities. Often there is little time for teachers to receive training and implement new technologies. Online training has the potential to deliver instruction that accommodates teachers' need to manage complex schedules. This research describes the efficacy of an online training program designed to aid teachers in the implementation of Turning Technologies Turning Point student response system into their classroom. The training program was designed to provide the basic knowledge to support teachers using the system with a minimal time investment and with anytime access to instruction. Quantitative and qualitative data were collected. The average number of correct answers on a test of best use practices administered before and after instruction increased from 50% to 80%. Participants reported favorably about the value of the training, although results are limited by a small sample size.

## **Introduction**

One truism in education is that there is never enough time for teachers to do all of the things they would like or need to do. The State of Hawaii education system has compounded this situation with the reduction of the school calendar by seventeen days in school years 2009-10 and 2010-11 to address budget concerns. An effect of this decision is the reduction in the amount of training conducted during school in an attempt to limit lost class time for teachers, thus necessitating alternative methods to provide needed training within schools.

## **Background**

This paper looks at an attempt to provide training to teachers at Lahaina Intermediate School who have access to Turning Technologies' Turning Point, a Student Response System (SRS). The system is comprised of polling software, response devices, and a receiver. Teachers can pose questions to a class of students, have them provide answers to the question utilizing their response device, and then display the responses to the class. The school has access to six SRS but they have gone largely unused for the last three years. The need for training and support was a major factor for these systems not being

utilized at the school. The training described in this paper was developed as one answer to the question: Can busy teachers be helped to incorporate new technology into their classrooms when there are so many demands on their time?

Research has identified a variety of benefits for students and teachers from the implementation of SRS in the classroom. The system promotes communication by all students; most particularly those students who are more introverted and less likely to openly participate in class (Johnson & McLeod, 2004/2005). The system allows for students to respond anonymously. Students can explore answers in a non-threatening way (Davis, 2003) and participate in class without the stigma of making a mistake visible to all (Wit, 2003).

Students reported favorably on how the use of SRS changed classroom dynamics. Students are encouraged when viewing whole class results because the range of displayed answers show they are not alone in working to understand the material (Boyle & Nicol, 2003). Fies & Marshall (2006) reported that students find the interactive nature of the SRS makes classes more engaging and enjoyable.

Teachers reap benefits from the use of SRS as well. The immediate feedback provided by the system allows teachers a chance to provide timely remediation. Lectures containing interactive questions interposed throughout the class kept students attention better than a normal lesson (Boyle & Nicol, 2003). Students described being more engaged in class and had more time to process new ideas in the course of answering the interactive questions. The immediate and complete feedback of student answers offers teachers the ability to utilize different classroom strategies to promote class discussion that would not be possible without the display of student responses afforded by the devices (Beatty, 2004).

For all of the benefits that the use of SRS can deliver, there are important considerations in the implementation of this technology. In one school the degree of technical difficulties in the first few weeks of implementation led to a large divide in the number of students who preferred the use of SRS in a class. Sixty-one percent of students in one class said they preferred the use of SRS compared to just 15% in another class that had several problems with the system at the beginning of the session (Guthrie & Carlin, 2004). Teacher inexperience with the system can be a factor in acceptance of the technology (Martyn, 2004). Finally, Beatty (2004) reported that support is an important component of any implementation strategy and must include pedagogical as well as technological support.

The time constraints inherent in the situation described earlier suggest that teachers be supported in such a way that they have anytime, anywhere access to training materials. Teachers who participate in self-paced training prefer to see how the content and course design will ultimately aid them in their training (Dobrovlny, 2006). A key feature in the course design is that teachers want to have some control over the depth and importance they give to each of the components of instruction

## Methodology

The delivery method for the instruction was decided upon early in the process. To accommodate the “anywhere, anytime” criteria, the instruction was designed to be delivered via an online web-based system.

The overall instructional design process was guided by a system developed by Dick, Carey, & Carey (2005). The instructional goal for the training was to have teachers able to convert an existing lesson plan and deliver an interactive lesson using the hardware and software in the Turning Technologies Turning Point system.

A system analysis was conducted on the school looking at the population and context in which the materials would be used. An instructional analysis resulted in five performance objectives for the training site:

1. Teachers who have completed the training should be able to convert a regular lecture-type lesson into an interactive lesson incorporating suggested best use practices for working with SRS.
2. Teachers who have completed the training should be able to create a presentation that has four – five interactive elements correctly embedded into the presentation.
3. Teachers who have completed the training should be able to create a participant list that correctly pairs students with response systems transmitters.
4. Teachers who have completed the training should be able to initialize and use the student response system hardware components for an entire class period.
5. Teachers who have completed the training should be able to save the response data from a presentation and create a *Results by Question* report.

An instructional analysis diagram (see appendix) was created that incorporated the first two objectives listed above. While a formal diagram was not created for the remaining objectives, the developer was mindful of the entry behaviors and subordinate skills required to meet these objectives.

Based in part on the use of a web-based delivery system an instructional strategy was developed that utilized multimedia instructional materials. This strategy offers advantages that more traditional paper based systems could not offer. Current brain research has posited that information is processed using separate temporary storage buffers in the brain. Verbal or textual elements are held in one buffer while visual or spatial elements are held in another. They are combined as the information moves from working memory into long-term memory (Cisco Systems, Inc., 2008). This “dual-coding” is helpful because “Convergence in the creation of memory traces has positive effects on memory retrieval. It creates linked memories, so that the trigger of any aspect of the experience will bring to consciousness the entire memory, often with context” (Cisco Systems, Inc., p. 10).

The instructional content was divided into ten separate multimedia pieces. One piece dealt with the best use practices information and was constructed as a Flash module. The content was divided into three strands after a brief introduction. The learner had control

over the order in which the strands were accessed although they were listed in the natural order they would be applied during the lesson conversion process. The remaining nine pieces were created using DemoCreator, a screen capture and editing software. The resulting videos presented information about using the Turning Point hardware and software. The videos demonstrated discrete tasks and they were listed on the training site in the natural order in which they would occur in the overall process.

All materials were prepared using general guidelines suggested by Mayer & Moreno (2003) for reducing cognitive load in multimedia learning. Cognitive load occurs as students attempt to make sense of the information they are processing while engaged in learning. The guidelines incorporate the idea of “dual-coding” mentioned previously. Retention is improved by using words and pictures rather than just words. Learning is enhanced when the words and pictures occur simultaneously rather than serially. Learning is enhanced when the words are narrated more so than when they are presented as text. Finally, careful thought was given to which features to include in the module/videos as the addition of extraneous, non-essential to the main learning objective, features can have a negative impact on learning.

Three data collection devices were created in conjunction with the content materials. A five question multiple-choice pre-test and post-test and a post-instruction survey were created using the form feature of Google docs. The pre-test and post-test was aligned with the best use practices module to gauge user learning of the material. Since the other videos would be classified more as “how to” instructions no similar tests were constructed. The survey was used to gain feedback about the value of each video/module specifically and the site in general.

The web site developed for instruction consisted of several web pages. The home page for the site presented an overview to the learner of the organization of the site. Each video was on an individual page that contained a text summary of the video, a 660 x 370 pixel version of the video embedded into the page, and a link to a full screen version of the video. Finally, there was a resource page that provided links to other web sites that provided a community of users and resources to access, links to all of the data collection documents needed for this paper, and the email address of the site developer in case further support was needed.

The finished materials and web site were presented to a subject matter expert (SME) for comment and recommendations. The SME is a Science teacher who has used the SRS extensively since early in the school year. The SME submitted several suggestions for improving the site and content of the videos. Many of the site-based suggestions were implemented. Time constraints limited the implementation of changes to the completed videos prior to the study, although they will likely be done at a later date.

The site was released for use in early February, 2010. All teachers at the school were solicited as participants. A special emphasis was placed on those teachers most likely to utilize the SRS. The developer attended department meetings for all four core content areas to explain the nature of the program and to request participation in the project. In

order to expand the potential base of users for the data collection component of this paper the developer posted an email invitation on a list service for Department of Education technology coordinators (TC). A TC from one other school expressed interest in the material and the developer sent an email to the TC describing the program and a separate email that was designed to be sent to the teachers at that school describing the program and inviting the teachers there to participate.

## Results

The data collection period lasted three weeks. Six people participated in some form in the study. All six people took the pre-test for the Best Use module while only four people took the succeeding post-test. Four people completed the post-instruction survey. Of the six, only two people completed all three forms.

The test results from the Best Use module were strictly quantitative. The average percent of correct answers for people taking both tests improved from 50% to 80% correct. The range of improvement for individual test takers went from zero additional correct answers in one case to three additional correct answers in the most extreme case.

The post-instruction survey provided a blend of quantitative and qualitative data. Participants were asked to rate the helpfulness of each video on a three point Likert scale or to note that they had not watched the video (see Table 1). Participants could also add a comment on each video. Finally, participants were required to comment on two areas – features of the site that were most beneficial to their understanding of implementing SRS in the classroom and changes they would recommend for improving the instruction.

**Table 1.** Usefulness Ratings for Instructional Elements

Element Title	Very	Somewhat	Not At All	Did not Watch
Best Use Practices	4	0	0	0
Creating a Basic Slide	4	0	0	0
Setting a Correct Answer	3	1	0	0
Inserting a Countdown Timer	3	1	0	0
Creating an Import File	4	0	0	0
Creating a Participant List	2	2	0	0
Modifying & Deleting a Participant List	2	1	0	1
Running a Presentation	2	1	0	1
Using the TP Showbar	3	1	0	0
Generating Reports in TP	3	1	0	0

Note. Values represent number of responses for each item.

Three participants reported watching all ten videos, while one participant watched eight of ten videos. Two of the three participants viewing all ten videos rated each video as “very helpful” (3 on the Likert Scale). The third participant viewing all of the videos rated five videos as “very helpful” and five videos as “somewhat helpful” (2 on the Likert scale). The person watching just eight videos rated five as “very helpful” and three as “somewhat helpful”. No one rated any videos as “not helpful” (1 on the Likert scale).

Three videos were identified by all participants as “very helpful”. Those videos addressed best use practices, creating a basic slide in Turning Point, and creating an import file that simplified the creation of participant lists in Turning Point. The least successful video according to the ratings was on the creation of participant lists. One participant commented that it was “kind of confusing when talking about ‘comma delimiting’ rather than spread sheet”.

One theme emerged when analyzing the data and that was participants believed the instruction was of value to them as they considered implementing SRS in the classroom. This view is based on the overall high Likert scale ratings given on the individual movies and the following comments:

- “Hearing and seeing exactly what to do makes all the difference for me. I could see where to go, hear it, and see the results.”
- “I like the way its broken into steps with exact steps to follow.”
- “Pretty much everything was new to me. I probably could have installed and used the clickers in my classroom without the training module. However, now that I have seen all the other functions I know I will be able to use them more effectively.”
- “Very well done! Voice very clear - directions simple and direct. The slow pacing will help me when I refer back for help!”

The participants did have some recommendations for changes to improve the instruction, among those were:

- “Would be helpful for an option to view the whole presentation at once (seemed to take a long time to click and load each section).”
- “Maybe a video of them being used in the classroom.”
- “Maybe a FAQ.”
- “Maybe sample lesson plans.”

Viewed in the context of the instructional design process mentioned earlier (Dick, et al., 2005), the implementation and data collection conducted during this project would represent the small group evaluation phase of the design process. Potential revisions to the instruction will be discussed in the following section.

## **Discussion**

The time frame of this study made it difficult to fully answer the question posed about whether teachers can be helped to implement new technology into their classrooms

despite the many demands on their time. The early answer appears to be yes based on the results from the study.

Many factors limit the extrapolation of the results to a larger context. One factor is the limited number of people who completed the post-instruction survey – four. The results are further limited by the poor quality of responses from the participants to the two narrative questions. One person listed a single beneficial feature of the instruction and zero recommendations for the improvement of instruction. Another participant replied in some length to both questions but the reply did not address the prompt in any meaningful way. Thus, the comments listed in the results section were listed from just two of the participants.

Even though the number of participants was limited their comments identified areas for improvement, starting with the lowest rated video, the one on creating participant lists. The video will be reedited, clarifying the use of specialized terminology. There are good examples of the response system technology on the Internet. Links to those videos can be added to the Resources page. Another suggestion was to have an FAQ (Frequently Asked Questions) on the site. This is a good idea that can be developed and incorporated into the site as current and future users ask for help in using the system.

The instruction developed for this module addressed only one of the software tools available with the Turning Point system. There is software called Testing Point that is a plug-in for Microsoft Word and it allows the user to create interactive testing instruments. There is additional Turning Point software that allows a teacher to create questions for the class without the need of adding it to a PowerPoint slide. Similar instruction to the ones already created could be developed and added to the site to help teachers expand their use of the Turning Point system to these other software items as well.

The genesis of this project occurred while performing my duties as the technology coordinator at Lahaina Intermediate School. The Turning Point equipment was a sizable investment for the school and was largely unused. The results of the study have confirmed for me that instruction of this sort is valued and will be used. The easy access worked for teachers and it frees my time from the repetition of having to train new users. The lasting result of this study will be that this is only the first of many different kinds of training I provide as a technology coordinator that will be developed into online web-based instruction.

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## APPENDIX

### Instructional Analysis Diagram for Best Use Module

Given the choice of a standard lesson to convert into an interactive lesson a teacher will be to modify the lesson by creating four to five “well-constructed” multiple choice questions that spaced throughout the lesson and decide on a delivery method for each question.

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